VIII.6 New York State Hi-Way Initiative (New Project)*

Richard Bourgeois, P.E.
General Electric Global Research
1 Research Circle
Niskayuna NY 12309
Phone: (518) 387-4550; E-mail: richard.bourgeois@crd.ge.com

DOE Technology Development Manager: Arlene Anderson
Phone: (202) 586-3818; Fax: (202) 586-9811; E-mail: Arlene.Anderson@ee.doe.gov

Subcontractors: State University of New York at Albany (SUNY)

**Congressionally directed project*

Objectives

- Quantify market requirements for low-cost electrolysis systems.
- Develop technical concepts to enable low-cost electrolysis.
- Explore materials and methods for high-performance electrochemical cells.
- Validate key concepts in laboratory testing.
- Demonstrate a bench-scale system incorporating developed concepts.
- Establish a hydrogen education and outreach initiative (SUNY).
- Develop a novel hydrogen sensor concept (SUNY).
- Report conceptual design for technology validation and demonstration.

Technical Barriers

This project addresses the following technical barriers from the Hydrogen Production section of the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research, Development and Demonstration Plan:

- Q. Capital Cost of Electrolysis Systems
- T. Renewable Integration

Approach

The primary technical barrier to be addressed by this project is the high cost of hydrogen as produced by electrolysis systems. For hydrogen producers with access to wholesale, off-peak electricity (electric utilities, for example), the cost of hydrogen is dominated by the capital cost of the electrolysis equipment, including financing costs.

For an electrolyzer with a hydrogen production capacity of 20 kg/h, the bulk of the cost is in the electrolyzer stack itself. The largest contribution to stack cost comes from the stack support raw material, typically a stainless steel, and the manufacturing and labor costs involved in forming stack plates and assembling the stack. We are exploring engineered plastics as the primary stack structure material and believe that such materials show potential to reduce both raw material and manufacturing costs enough to reach the necessary cost targets. Our research in this area will focus on the selection of a plastic and a manufacturing method, taking into account the strength and long-term creep behavior, forming limits, pressurization capability, permeability, and stability of the material. In addition, we will solve the design problem of incorporating electrodes and other conductive materials necessary for the function

of the electrolyzer into the structure of the plastic, which is inherently non-conductive.

Research at General Electric will also explore means of improving the performance of the electrolyzer and system in order to allow for smaller and therefore less expensive components to provide the target hydrogen production rate. Efforts in this area include research on electrode and diaphragm materials, novel electrolyte development, and means for enhanced gas separation and heat control.

Activities in the quarter ending 30 June focused on customer requirements and the selection of technology concepts with potential to meet those requirements. In the coming year, we intend to use small stack test vehicles and modeling to select from these concepts a complete technology concept for an electrolyzer system to meet the customer requirements and DOE program goals. The project will conclude in April 2005 with a conceptual design for the electrolyzer with predictions of hydrogen cost validated by analysis and small stack experiments.